White Mould of Soybean

White mould is a fungal disease that can attack hundreds of plant species. Also known as Sclerotinia stem rot, it has become an annual threat to soybeans in northern growing areas throughout North America. When wet, cool conditions prevail during flowering, the disease can be found in central states as well. When severe infestations occur, primarily due to sustained wet weather conditions, losses may be substantial. The spread of white mould in recent years is likely due to cultural practices that have accelerated canopy development, including earlier planting and narrow row spacings.

Disease Description and Life Cycle

Sclerotia on stem.

White mould persists in soybean fields over time by production of survival structures called sclerotia. These dark, irregularly shaped bodies about ½-inch long are formed within the white, cottony growth both inside and outside the stem during the fall. These sclerotia contain food reserves and function much like seeds, surviving for years in the soil and eventually germinating, producing millions of spores beneath the soybean canopy.

White mould spores are not able to invade plants directly but must colonize dead plant tissue before moving into the plant. Senescing flowers provide a ready source of dead tissue for preliminary colonization. From these flowers in the branch axils or stuck to developing pods, the fungus spreads to healthy tissue. Stem lesions develop and may eventually be overgrown with white mould. The disease can then spread directly from plant to plant by contact with this mouldy tissue. Sclerotia are formed within the mouldy growth and inside the stem to complete the disease cycle.

Wet, cool conditions are required throughout the white mould disease cycle, including germination of the sclerotia in the soil, spore release, infection of soybean flowers by spores, and spread of white mould from plant to plant. As the disease progresses, tissue rots and sclerotia form inside the stem, often leading to rapid wilting and death of the entire plant.

Management of White Mould[1]

White mould is often a disease of high yield potential soybeans, but abandoning high yield management practices to control the disease may be counter-productive. Rather, a systems approach that includes avoiding disease spread, selecting tolerant varieties, adjusting cropping systems, and applying specific fungicides or herbicides can reduce soybean damage during white mould outbreak years.

Disease Avoidance - White mould spreads either by movement of spores or sclerotia from field to field. There is little known about stopping the spread of spores. Sclerotia move from field to field in harvest equipment or in contaminated seed. Harvest equipment should be thoroughly cleaned when moving from infected to non-infected fields. Harvesting infected fields last provides additional safety. DuPont Pioneer avoids growing seed beans in fields with a history of white mould. Seed is also thoroughly cleaned and inspected to ensure that it is disease-free. Seed cleaning with a gravity table or centrifugal tower is essential to remove sclerotia. Fungicide seed treatments can help ensure that no disease is transmitted by mycelia present on seed.

White Mould Development: Long-Term Risk Factors

The North Central Plant Health Initiative has developed the following list of risk factors for white mould:[a]

Field/Cropping History - Pathogen level will gradually increase if:

- Other host crops are grown in rotation with soybean.
- Only 1- to 2-year intervals occur between soybean crops.
- White mould susceptible varieties are grown.

Weed Management Systems - Inoculum will increase if control of broadleaf weeds is ineffective. Some herbicides used in rotation systems may be suppressive to white mould.

Topography of Field - Pockets of poor air drainage, tree lines, and other natural barriers that impede air movement will create a favorable micro-environment for white mould development.

Pathogen Introduction:

- Contaminated and infected seed.
- Movement of infested soil with equipment.
- Wind-borne spores from apothecia in areas outside fields.

[a] Adapted from: North Central Soybean Research Program, Plant Health Initiative. http://www.planthealth.info/whitemould_basics.htm

Variety Selection - At this time, there is no complete genetic resistance to white mould – all varieties can develop white mould symptoms under severe infestations. But varieties do differ, and DuPont Pioneer researchers assign each Pioneer® brand soybean variety a 1 to 9 rating based on these differences. These scores reflect varietal differences in the rate at which the infection develops and the extent of damage it causes. Growers can use this rating to help choose the best variety for their field (higher scores indicate more tolerance). However, because there is no complete genetic resistance available at this time, white mould may sometimes occur even with above-average tolerance scores. Your local Pioneer sales professional can suggest white mould tolerant varieties with a complete package of traits needed for top soybean production in your area.

Pioneer researchers have targeted improvement of varieties for white mould tolerance as a key research objective. To accomplish this goal, soybean breeders use new lab and field techniques as well as conventional selection in white mould environments. These scientists also continue to screen novel, exotic, and alternative germplasm sources with native tolerance to white mould. Future possibilities include transgenic approaches – transferring resistance genes from other crops or organisms into soybeans.

Cropping Systems

Tillage - Sclerotia germinate from the top two inches of soil. Below that depth, they can remain dormant for up to 10 years. Because of its longevity in the soil, it is difficult to devise a strategy to control white mould with tillage. Deep tillage buries sclerotia from the soil surface but may also bring prior sclerotia into their zone of germination. If the disease is new to a field and a severe outbreak has occurred, a deep tillage followed by no-till or shallow tillage for many years may be beneficial. Research studies have shown that no-till is generally superior to other tillage systems in limiting white mould development.

Rotation - Rotation with a non-host crop is an effective means of reducing disease pressure in a field. Non-host crops include corn, sorghum, and small grains. Susceptible crops to avoid in a rotation include alfalfa, clover, sunflower, canola, edible beans, potato, and others. Depending on soybean tolerance, field history, and other factors, more than one year away from soybeans may be required. Because sclerotia survive for up to 10 years in the soil, rotation is only a partial solution.

Foliar fungicide application to soybeans.
Photo courtesy of John Deere

Chemical Application[2]

DuPont™ Acapela® - In research trials conducted by Ohio State University, Michigan State University, and the University of Illinois in 2009 to 2011, Acapela® fungicide reduced white mould severity and increased yield by 7.2 bu/acre (Wessel and Butzen, 2013). The Acapela fungicide label specifies to make an initial preventative application at 100% bloom (one flower blooming on all plants) and follow with a second application 7 to 10 days later at full bloom. A second application is most important if cool, wet environmental conditions conducive to disease development persist throughout flowering. Apply Acapela in a minimum volume of 10 gal/acre. Penetration of spray droplets into the lower canopy is critical to achieve optimum efficacy. Ensure spray volume and spray pressure are optimized to achieve thorough coverage.

Priaxor is another foliar fungicide labeled for white mould control in soybeans. Always read and follow label directions and precautions for use when applying fungicides. Labels contain important precautions, directions for use, and product warranty and liability limitations that must be read before using the product.

Production Practices - It is well-established that many current practices that increase soybean yields also increase white mould. Whether growers should abandon their yield-enhancing practices to help control white mould is debatable. In areas with lower white mould levels or drier climate, production practices that increase yield but also increase white mould levels may still be highest yielding. However, in areas with higher white mould levels and a cool, wet climate, some change in production practices may be necessary to limit early, dense canopy development.

Row Width - A review of soybean row-spacing studies published within the past 10 years generally confirms previous results comparing 30-inch rows and drilled narrow rows. In 5 studies, drilled soybeans outyielded 30-inch row soybeans by an average of 4.1 bu/acre. Six studies that compared 30-inch rows and 15-inch rows found that 15-inch rows increased yield by 3.6 bu/acre. Yields were similar between 15-inch row and drilled narrow-row soybeans in these studies.

A 6-year research study in Wisconsin measured yield and white mould incidence in 7-inch (drilled) vs. 30-inch rows (Grau, 2001). Though white mould mortality was much higher in drilled beans, the yields were nevertheless equal or higher for drilled vs. 30-inch rows when averaged across years.

These results suggest that narrow-row planting systems should not necessarily be abandoned simply to help control white mould. In fact, narrow-row systems generally increase yields each year, and white mould does not develop every year. However, because research studies have shown that 15-inch rows often yield as well as 7-inch rows, many growers in white mould areas have chosen the 15-inch row width.

Planting Date - Later planted soybeans are generally shorter and less branched and therefore, later to canopy closure. Some planting date studies show that later planting results in less incidence of white mould. However, yields are generally reduced when planting is delayed past mid-May in northern states. The trade off between less yield reduction due to white mould but more yield reduction due to late planting may not be favorable, especially in years of low disease pressure.

Plant Population - Soybean yields generally increase with increased plant population within a range. Studies have demonstrated higher white mould incidence with higher plant population, but yields were not reduced. However, part of the expected increase from higher seeding rates was likely offset by losses from the disease. In fields with high risk of white mould, seeding rates should be sufficient for uniform stand establishment but should not be aggressively high. Actual rates will vary depending on planting date, seedbed conditions, row width, and seed quality.

Weed Control - White mould has over 400 plant hosts, including many broadleaf weeds. Host weeds that are also common weed species throughout soybean growing areas include lambsquarters, ragweed, pigweed, and velvetleaf. In addition to acting as host to the disease, weeds can also increase canopy density, which favors disease spread.

[1] Many factors, including weather, influence white mould levels and crop damage from year to year. Your results may vary.

[2] This article is not intended as a substitute for the product label for the products referenced herein. Product labels for the above products contain important precautions, directions for use and product warranty and liability limitations that must be read before using the product. Always read and follow all label directions and precautions for use when using any pesticide. Mention of a product in this article does not imply an endorsement.